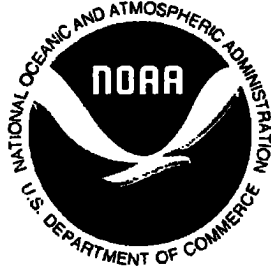


**NOAA NESDIS**  
**CENTRAL SATELLITE DATA PROCESSING CENTER**



**Advanced Very High Resolution  
Radiometer (AVHRR) Level 1b Format  
Specification for NOAA-N and the IJPS Era**

**Version 1.1**

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**Computer Sciences Corporation**  
**Laurel, Maryland**

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# 1 Introduction

This document describes the AVHRR Level 1b format, which is being updated for the JPSS era, beginning with NOAA-N. This updated format will be applicable for all AVHRR Level 1b data sets from the NOAA-KLMNN' and Metop satellites beginning at or around the launch of NOAA-N.

Level 1b format specifications for the primary header record and the data record of all types of AVHRR data (see below) are provided in this document. Please note that as part of the updates to the Level 1b formats for NOAA-N and the JPSS era is the inclusion of additional, or secondary, header records. They will contain ancillary data set names and any metadata needed for, primarily, reprocessing. Currently, the content and format of any secondary header record is TBD. Applications that will access AVHRR Level 1b data sets should use the "Count of Header Records in this Data Set" field, located in the first, or primary, header record, to calculate the position of the first data record and skip the secondary header records.

The type of AVHRR data received from the spacecraft and/or output into Level 1b data sets by the preprocessing software falls into two main categories: (1) full resolution and (2) reduced resolution. The full resolution (i.e., 1 km) AVHRR data includes LAC (from NOAA satellites only), HRPT (from both NOAA and Metop satellites), and FRAC (Metop only). (FRAC is the full resolution orbital AVHRR data from Metop.) The reduced resolution (i.e., 4 km) AVHRR data includes GAC (NOAA only) and reduced resolution (i.e., "GACized") FRAC (Metop only). The latter is FRAC data that has been sub-sampled by the preprocessing software to yield a GAC-like 1b output for those products and applications that can only handle GAC resolution data.

## 2 Applicable Documents

Table 1 presents a list of applicable documents (AD-#).

Doc #	Title	Reference Number	Issue	Date
AD-1	Unique Instrument Interface Specification for the AVHRR/3	IS 20029950	J	June 18, 2001
AD-2	AVHRR/3 Instrument Interface Control Document	MO-IC-MMT-AH-0001	4, rev. 0	January 2001
AD-3	NOAA KLM User's Guide			Sept. 2000

Table 1 - Applicable Documents

## 3 Data Representation and Storage

This section describes the bit and byte numbering conventions used in this document, and the storage methods for integers and floating point numbers. This information is especially critical when transporting data from one computer architecture to another. Without special handling, data produced on one system may be unusable on another due to differences in internal data storage.

### 3.1 Bit Numbering

A byte in this document is defined as containing 8 bits. A word is 8, 16, or 32 bits in length. In all cases, the least significant bit (lsb) is designated as bit 0 and has a base-10 value of  $2^0 = 1$ . Therefore, in an 8-bit word the most significant bit (msb) is designated as bit 7, and has a base-10 value of  $2^7 = 128$ . In a 16-bit word the msb is designated as bit 15, and has a base-10 value of  $2^{15} = 32,768$ . In a 32-bit word the msb is designated as bit 31, and has a base-10 value of  $2^{31} = 2,147,483,648$ .

### 3.2 Signed Integers

For signed binary integers, the msb represents the sign of the number. The remaining bits (bits 6 through 0 for 8-bit words, 14 through 0 for 16-bit words, and 30 through 0 for 32-bit words) are used to designate the magnitude of the number. Therefore, the range of signed binary integers is based on word size as follows:

- 1 byte    -128 to 127
- 2 bytes   -32,768 to 32,767
- 4 bytes   -2,147,483,648 to 2,147,483,647

Positive binary integers are in true binary notation with the sign bit set to zero. Negative binary integers are in two's-complement notation with the sign bit set to one. Negative binary integers are formed in two's-complement notation by inverting each bit of the positive binary integer and adding one.

### 3.3 Unsigned Integers

Unsigned binary integers use all bits including the msb to represent the magnitude of the number. Therefore, their range is as follows, again, based on word size:

- 1 byte    0 to 255
- 2 bytes   0 to 65,535
- 4 bytes   0 to 4,294,967,295

A field containing a binary integer is given the data type of unsigned integer if its content will never be negative or if a negative value just does not make sense for that field. For example, the idea of a negative scan line number or negative date or time is nonsensical. Therefore, fields containing scan line numbers, dates, and times are labeled as unsigned integers.

Unfortunately, this data type is not supported by all computer languages (e.g., Fortran), so additional data manipulation may be necessary. In the case of reading a 16-bit unsigned integer (DATA), a Fortran user could use the following code snippet to extract the actual value (VALUE):

```
...  
INTEGER*2 DATA  
INTEGER*4 VALUE  
...  
READ DATA  
IF (DATA .LT. 0) THEN
```

```

        VALUE = 65536 + DATA
ELSE
        VALUE = DATA
ENDIF
...

```

But note that nearly all unsigned integer fields can be safely read into signed integer data types of the same word sizes. This is because they were originally written to the 1b using signed integer data types, and thus will be within the positive range of the corresponding signed integer data type (see Section 3.2). The 1b format specifications will clearly indicate, by providing ranges, those unsigned integer fields that must be strictly treated as unsigned integer data types--using the data manipulation described above, if necessary--to ensure that correct values are retrieved.

However, not all fields of an unsigned integer data type contain unsigned binary integers. Fields containing *packed data* are also identified as unsigned integers. While its msb is not a sign bit, a field containing packed data does not represent an unsigned binary integer. Such a field requires the user to perform some type of special unpacking technique in order to extract the information of interest from the field in order for it to be interpreted correctly. Packed data may be bit fields, packed integers, or both. A bit field is one or more consecutive bits used to indicate one of two or more possible conditions or states. (A *bit flag* is a specialized instance of a bit field. It is a single bit indicating one of only two possible conditions.) For example, a three-bit field may indicate which of seven different modes that an instrument is operating in (i.e., 0 implies "power on mode", 1 implies "warm up mode", 2 implies "standby mode", etc.). A packed integer is simply a binary number that is stored in just a subset of an unsigned integer field's bits. Although similar to a bit field, a packed integer is not an indicator of a condition, but an actual numeric value having magnitude that, once unpacked, could be used in arithmetic computations.

### 3.4 Scaled Integers

To provide maximum portability of the Level 1b data sets across different computer platforms, floating point data is represented by scaled integers. Scaled integers can be either signed or unsigned, and are simply floating point numbers multiplied by a fixed scaling factor so that a sufficiently precise representation of the original number can be stored in integer form. For example, the floating point value 1.2313 might be multiplied by  $10^2$  to achieve an integer value of 123. To achieve better precision, the floating point value might be multiplied by  $10^3$  or  $10^4$  to achieve an integer value of 1231 or 12313, respectively. In the Level 1b data sets, the scaling factors are powers of ten, and only the exponents (2, 3, and 4 in the previous examples) are documented within the data set. To recover an approximation of the original floating point value, divide the integer value by ten raised to the given exponent.

### 3.5 Byte Ordering

A major problem impeding the free transport of binary data from one computer system to another is the "Big Endian - Little Endian" dichotomy. *Big Endian* systems (e.g. IBM 370, Macintosh, SGI, Sun SPARC) store bytes of binary numeric data in reverse order relative to *Little Endian* systems (e.g. IBM PC, DEC Alpha). For example, a 32-bit hexadecimal value of x01020304 (decimal value 16,909,060) written to a binary file by a Big Endian system would be

read from the file as x04030201 (decimal value 67,305,985) by a Little Endian system. Level 1b data sets generated and archived by NOAA are in Big Endian order; users with Little Endian systems must include an additional byte-swapping step when reading binary numeric data from Level 1b data sets produced by NOAA. Some processors support byte swapping in their instruction sets, but others must use compiler-dependent functions.

## 4 AVHRR Level 1b Format Specifications

The format specifications for the AVHRR Level 1b header record and AVHRR Level 1b data record are given in this section. The meaning of each column in the format specifications is defined in Table 2.

Name	Description
Field Name	The name or brief description of the field.
Start Octet	Offset location of first octet in the defined field from beginning of record, starting with octet 1. (Note that the terms "octet" and "byte" are used interchangeably and mean the same thing.)
End Octet	Offset location of last octet in the defined field from beginning of record.
Data Type	Data Type (i - integer, u - unsigned integer, c - character). Character data is stored as ASCII.
Word Size	Number of octets per data word.
Number of Words	Number of words of indicated size and type contained in the defined field.
Scale Factor	Scaling Factor.
Units	The field's unit of measurement (e.g., octets, counts, Kelvin, volts), if applicable.
Notes	References to notes that follow the format specifications in Section 6.

**Table 2 - Description of Format Specification Columns**

## 4.1 AVHRR 1b Primary Header Record Format

NOTE: Except for the zero-fill padding, the primary header record specification is identical no matter the type of AVHRR data.

Field Name	Start Octet	End Octet	Data Type	Word Size	Number of Words	Scale Factor	Units	Notes
<b>FILE IDENTIFICATION</b>								
Data Set Creation Site ID CMS=Centre de Meteorologie Spatiale/France DSS=Dundee Satellite Receiving Station/UK NSS=National Environmental Satellite, Data and Information Service/USA UKM=United Kingdom Meteorological Office/UK <ASCII blank = x20>	1	3	c	3	1	0		
Level 1b Format Version Number	5	6	u	2	1	0		
Level 1b Format Version Year (four digits, e.g., 2000)	7	8	u	2	1	0		
Level 1b Format Version Day of Year (e.g., 365)	9	10	u	2	1	0		
<Reserved for Logical Record Length> (For Creation Site use only. Logical Record Length of source 1b data set prior to processing.)	11	12	u	2	1	0	Octets	
<Reserved for Block Size> (For Creation Site use only. Block Size of source 1b data set prior to processing.)	13	14	u	2	1	0	Octets	
Count of Header Records in this Data Set	15	16	u	2	1	0		
<Zero Fill>	17	22	i	2	3	0		
Data Set Name	23	64	c	42	1	0		
Processing Block Identification	65	72	c	8	1	0		
Spacecraft Identification Code 0=NOAA-L 1=NOAA-K 6=NOAA-M 7=NOAA-N 8=NOAA-N' 11=Metop-1 (TBC) 12=Metop-2 (TBC)	73	74	u	2	1	0		
Instrument ID 301=s/n A301 (NOAA-L) 302=s/n A302 (NOAA-K) 303=s/n A303 (NOAA-N') 304=s/n A304 (NOAA-M) 305=s/n A305 (Metop-2) 306=s/n A306 (NOAA-N) 307=s/n A307 (Metop-1)	75	76	u	2	1	0		
Data Type Code 1=LAC (NOAA only) 2=GAC (NOAA GAC or "GACized" FRAC) 3=HRPT (NOAA or Metop) 13=FRAC (Metop only)	77	78	u	2	1	0		
TIP Source Code (NOAA: values defined below) or <Zero Fill> (Metop) 0=unused, i.e., GAC/HRPT/LAC data 1=GAC-embedded AMSU and TIP 2=stored TIP (STIP) 3=HRPT/LAC-embedded AMSU and TIP 4=stored AIP (SAIP)	79	80	u	2	1	0		
Start of Data Set Day Count starting from 0 at 00h, 1 Jan 1950	81	84	u	4	1	0		
Start of Data Set Year (four digits, e.g., 2000)	85	86	u	2	1	0		
Start of Data Set Day of Year (e.g., 365)	87	88	u	2	1	0		
Start of Data Set UTC Time of Day	89	92	u	4	1	0	milliseconds	
End of Data Set Day Count starting from 0 at 00h, 1 Jan 1950	93	96	u	4	1	0		
End of Data Set Year (four digits, e.g., 2000)	97	98	u	2	1	0		

Field Name	Start Octet	End Octet	Data Type	Word Size	Number of Words	Scale Factor	Units	Notes
End of Data Set Day of Year (e.g., 365)	99	100	u	2	1	0		
End of Data Set UTC Time of Day	101	104	u	4	1	0	milliseconds	
Year of Last CPIDS Update (four digits, e.g., 2000)	105	106	u	2	1	0		
Day of Year of Last CPIDS Update (e.g., 365)	107	108	u	2	1	0		
<Zero Fill>	109	116	i	2	4	0		
<b>DATA SET QUALITY INDICATORS</b>								
Instrument Status (These are bit flags taken from the AVHRR Digital B Data field on first data record for which all of the individual status flags have been reported at least once.) bits 31-16: <zero fill> bit 15: scan motor/telemetry status (0=off; 1=on) bit 14: electronics/telemetry status (0=off; 1=on) bit 13: channel 1 status (0=disable; 1=enable) bit 12: channel 2 status (0=disable; 1=enable) bit 11: channel 3A status (0=disable; 1=enable) bit 10: channel 3B status (0=disable; 1=enable) bit 9: channel 4 status (0=disable; 1=enable) bit 8: channel 5 status (0=disable; 1=enable) bit 7: channel 3A/3B select status (0=3B; 1=3A) bit 6: voltage calibration status (0=off; 1=on) bit 5: cooler heat status (0=off; 1=on) bit 4: scan motor mode status (0=low; 1=high) bit 3: telemetry lock status (0=not locked on; 1=locked on) bit 2: earth shield status (0=disable; 1=deploy) bit 1: patch control status (0=off; 1=on) bit 0: <zero fill>	117	120	u	4	1	0		
<Zero Fill>	121	122	i	2	1	0		
Record Number of Status Change (if 0, none occurred; range: 0 - 65,535)	123	124	u	2	1	0		
Second Instrument Status (if previous word is 0, no change)	125	128	u	4	1	0		
Count of Data Records in this Data Set (range: 0 - 65,535)	129	130	u	2	1	0		
Count of Calibrated, Earth Located Scan Lines in this Data Set (range: 0 - 65,535)	131	132	u	2	1	0		
Count of Missing Scan Lines (range: 0 - 65,535)	133	134	u	2	1	0		
Count of Data Gaps in this Data Set	135	136	u	2	1	0		
Count of Data Frames Without Frame Sync Word Errors (NOAA) or <Zero Fill> (Metop)	137	138	u	2	1	0		
Count of PACS Detected TIP Parity Errors (NOAA) or <Zero Fill> (Metop)	139	140	u	2	1	0		
Sum of All Auxiliary Sync Errors Detected in the Input Data (NOAA) or <Zero Fill> (Metop)	141	142	u	2	1	0		
Time Sequence Error (range: 0 - 65,535) 0=none; otherwise, the record number of the first occurrence	143	144	u	2	1	0		
Time Sequence Error Code (These are bit flags taken from Scan Line Quality Flags [Time Problem Code] on data record reported in Time Sequence Error field above. If a bit is on (=1) then the statement is true.) bits 15-8: <zero fill> bit 7: time field is bad but can probably be inferred from the previous good time bit 6: time field is bad and can't be inferred from the previous good time bit 5: this record starts a sequence that is inconsistent with previous times (i.e., there is a time discontinuity); may be associated with a spacecraft clock update bit 4: start of a sequence that apparently repeats scan times that have been previously accepted bits 3-0: <zero fill>	145	146	u	2	1	0		

Field Name	Start Octet	End Octet	Data Type	Word Size	Number of Words	Scale Factor	Units	Notes
SOCC Clock Update Indicator ( <i>range: 0 - 65,535</i> ) 0=none during this orbit; otherwise, the record number of the first occurrence	147	148	u	2	1	0		
Earth Location Error Indicator ( <i>range: 0 - 65,535</i> ) 0=none during this orbit; otherwise, the record number of the first occurrence	149	150	u	2	1	0		
Earth Location Error Code ( <i>These are bit flags taken from Scan Line Quality Flags [Earth Location Problem Code] on data record reported in Earth Location Error Indicator field above. If a bit is on (=1) then the statement is true.</i> ) bits 15-8: <zero fill> bit 7: not earth located because of bad time; earth location fields zero-filled bit 6: earth location questionable: questionable time code bit 5: earth location questionable: marginal agreement with reasonableness check bit 4: earth location questionable: fails reasonableness check bits 3-2: <zero fill> bit 1: not earth located because of satellite in-plane maneuver (Metop) or <zero fill> (NOAA) bit 0: not earth located because of satellite out-of-plane maneuver (Metop) or <zero fill> (NOAA)	151	152	u	2	1	0		
PACS Status Bit Field ( <i>NOAA: value defined below</i> ) or <Zero Fill> ( <i>Metop</i> ) bits 15-3: <zero fill> bit 2: pseudonoise (0=normal data; 1=pseudonoise data) bit 1: tape direction (0=reverse playback, time decrementing) bit 0: data mode (0=test data; 1=flight data)	153	154	u	2	1	0		
Data Source 0=unused 1=Fairbanks, AK 2=Wallops Is., VA 3=SOCC 4=Svalbard, Norway 5=Monterey, CA	155	156	u	2	1	0		
<Zero Fill>	157	160	i	4	1	0		
<Reserved for the Ingestor>	161	168	c	8	1	0		
<Reserved for Decommuation>	169	176	c	8	1	0		
<Zero Fill>	177	186	i	2	5	0		
<b>CALIBRATION</b>								
Ramp Calibration Indicators Bit Field ( <i>The ramp calibration signal consists of the output of a D/A generator that increases one step per revolution of the radiometer scanning system. The nominal ramp calibration in the A/D output skips a step approximately once every 62 scan revolutions, and once every 62 steps of the D/A ramp generation. Channels 1, 2, and 3A increment linearly with the scan count, except as previously noted, until the dual gain break point to 500 counts is reached. Channels 3B, 4, and 5 ramp values increment linearly with scan line count, except as previously noted. The following bit fields indicate non-linearity in the ramp calibration signal.</i> ) bits 15-6: <zero fill> bit 5: ramp non-linearity for channel 5 bit 4: ramp non-linearity for channel 4 bit 3: ramp non-linearity for channel 3B bit 2: ramp non-linearity for channel 3A bit 1: ramp non-linearity for channel 2 bit 0: ramp non-linearity for channel 1	187	188	u	2	1	0		
Year of Most Recent Solar Channel Calibration ( <i>four digits, e.g., 2000</i> )	189	190	u	2	1	0		
Day of Year of Most Recent Solar Channel Calibration ( <i>e.g., 365</i> )	191	192	u	2	1	0		

Field Name	Start Octet	End Octet	Data Type	Word Size	Number of Words	Scale Factor	Units	Notes
Primary Calibration Algorithm ID	193	194	u	2	1	0		
Primary Calibration Algorithm Selected Options bit 15: <zero fill> bit 14: Ch 5 resolution (0=high; 1=low) bit 13: Ch 5 substitution coefficients (0=no; 1=yes) bits 12-10: <zero fill> bit 9: Ch 4 resolution (0=high; 1=low) bit 8: Ch 4 substitution coefficients (0=no; 1=yes) bits 7-5: <zero fill> bit 4: Ch 3B resolution (0=high; 1=low) bit 3: Ch 3B substitution coefficients (0=no; 1=yes) bits 2-0: <zero fill>	195	196	u	2	1	0		
Secondary Calibration Algorithm ID	197	198	u	2	1	0		
Secondary Calibration Algorithm Selected Options bit 15: <zero fill> bit 14: Ch 5 resolution (0=high; 1=low) bit 13: Ch 5 substitution coefficients (0=no; 1=yes) bits 12-10: <zero fill> bit 9: Ch 4 resolution (0=high; 1=low) bit 8: Ch 4 substitution coefficients (0=no; 1=yes) bits 7-5: <zero fill> bit 4: Ch 3B resolution (0=high; 1=low) bit 3: Ch 3B substitution coefficients (0=no; 1=yes) bits 2-0: <zero fill>	199	200	u	2	1	0		
IR Target Temperature 1 Conversion Coefficient 1	201	202	i	2	1	2K		
IR Target Temperature 1 Conversion Coefficient 2	203	204	i	2	1	5K/counts		
IR Target Temperature 1 Conversion Coefficient 3	205	206	i	2	1	8K/counts <sup>2</sup>		
IR Target Temperature 1 Conversion Coefficient 4	207	208	i	2	1	11K/counts <sup>3</sup>		
IR Target Temperature 1 Conversion Coefficient 5	209	210	i	2	1	14K/counts <sup>4</sup>		
IR Target Temperature 1 Conversion Coefficient 6	211	212	i	2	1	17K/counts <sup>5</sup>		
IR Target Temperature 2 Conversion Coefficient 1	213	214	i	2	1	2K		
IR Target Temperature 2 Conversion Coefficient 2	215	216	i	2	1	5K/counts		
IR Target Temperature 2 Conversion Coefficient 3	217	218	i	2	1	8K/counts <sup>2</sup>		
IR Target Temperature 2 Conversion Coefficient 4	219	220	i	2	1	11K/counts <sup>3</sup>		
IR Target Temperature 2 Conversion Coefficient 5	221	222	i	2	1	14K/counts <sup>4</sup>		
IR Target Temperature 2 Conversion Coefficient 6	223	224	i	2	1	17K/counts <sup>5</sup>		
IR Target Temperature 3 Conversion Coefficient 1	225	226	i	2	1	2K		
IR Target Temperature 3 Conversion Coefficient 2	227	228	i	2	1	5K/counts		
IR Target Temperature 3 Conversion Coefficient 3	229	230	i	2	1	8K/counts <sup>2</sup>		
IR Target Temperature 3 Conversion Coefficient 4	231	232	i	2	1	11K/counts <sup>3</sup>		
IR Target Temperature 3 Conversion Coefficient 5	233	234	i	2	1	14K/counts <sup>4</sup>		
IR Target Temperature 3 Conversion Coefficient 6	235	236	i	2	1	17K/counts <sup>5</sup>		
IR Target Temperature 4 Conversion Coefficient 1	237	238	i	2	1	2K		
IR Target Temperature 4 Conversion Coefficient 2	239	240	i	2	1	5K/counts		
IR Target Temperature 4 Conversion Coefficient 3	241	242	i	2	1	8K/counts <sup>2</sup>		
IR Target Temperature 4 Conversion Coefficient 4	243	244	i	2	1	11K/counts <sup>3</sup>		
IR Target Temperature 4 Conversion Coefficient 5	245	246	i	2	1	14K/counts <sup>4</sup>		
IR Target Temperature 4 Conversion Coefficient 6	247	248	i	2	1	17K/counts <sup>5</sup>		
<Zero Fill>	249	256	i	4	2	0		
<b>RADIANCE CONVERSION</b>								
Ch 1 Solar Filtered Irradiance in Wavelength	257	260	i	4	1	1		
Ch 1 Equivalent Filter Width in Wavelength	261	264	i	4	1	3		
Ch 2 Solar Filtered Irradiance in Wavelength	265	268	i	4	1	1		
Ch 2 Equivalent Filter Width in Wavelength	269	272	i	4	1	3		
Ch 3A Solar Filtered Irradiance in Wavelength	273	276	i	4	1	1		
Ch 3A Equivalent Filter Width in Wavelength	277	280	i	4	1	3		
Ch 3B Central Wavenumber	281	284	i	4	1	2cm <sup>-1</sup>		
Ch 3B Constant 1	285	288	i	4	1	5		

Field Name	Start Octet	End Octet	Data Type	Word Size	Number of Words	Scale Factor	Units	Notes
Ch 3B Constant 2	289	292	i	4	1	6		
Ch 4 Central Wavenumber	293	296	i	4	1	3cm <sup>-1</sup>		
Ch 4 Constant 1	297	300	i	4	1	5		
Ch 4 Constant 2	301	304	i	4	1	6		
Ch 5 Central Wavenumber	305	308	i	4	1	3cm <sup>-1</sup>		
Ch 5 Constant 1	309	312	i	4	1	5		
Ch 5 Constant 2	313	316	i	4	1	6		
<Zero Fill>	317	328	i	4	3	0		
<b>NAVIGATION</b>								
Reference Ellipsoid Model ID ( <i>The ellipsoid is a mathematically tractable approximation of the geoid, which is an equipotential surface at mean sea level. The maximum departure of the ellipsoid from the geoid is approximately +/- 65 meters.</i> ) WGS-72=World Geodetic Survey 1972	329	336	c	8	1	0		
Nadir Earth Location Tolerance	337	338	u	2	1	1kilometers		
Earth Location Bit Field bits 15-3: <zero fill> bit 2: dynamic attitude error correction (0=not performed; 1=performed) bit 1: reasonableness test (0=inactive; 1=active) bit 0: constant attitude error correction (0=not performed; 1=performed)	339	340	u	2	1	0		
<Zero Fill>	341	342	i	2	1	0		
Constant Roll Attitude Error	343	344	i	2	1	3degrees		
Constant Pitch Attitude Error	345	346	i	2	1	3degrees		
Constant Yaw Attitude Error	347	348	i	2	1	3degrees		
Epoch Year for Orbit Vector	349	350	u	2	1	0		
Day of Epoch Year for Orbit Vector	351	352	u	2	1	0		
Epoch UTC Time of Day for Orbit Vector	353	356	u	4	1	0milliseconds		
Semi-major Axis ( <i>at the orbit vector epoch time</i> )	357	360	i	4	1	5kilometers		
Eccentricity ( <i>at the orbit vector epoch time</i> )	361	364	i	4	1	8		
Inclination ( <i>at the orbit vector epoch time</i> )	365	368	i	4	1	5degrees		
Argument of Perigee ( <i>at the orbit vector epoch time</i> )	369	372	i	4	1	5degrees		
Right Ascension of the Ascending Node ( <i>at the orbit vector epoch time</i> )	373	376	i	4	1	5degrees		
Mean Anomaly ( <i>at the orbit vector epoch time</i> )	377	380	i	4	1	5degrees		
Position Vector X Component ( <i>at the orbit vector epoch time</i> )	381	384	i	4	1	5kilometers		
Position Vector Y Component ( <i>at the orbit vector epoch time</i> )	385	388	i	4	1	5kilometers		
Position Vector Z Component ( <i>at the orbit vector epoch time</i> )	389	392	i	4	1	5kilometers		
Velocity Vector X-dot Component ( <i>at the orbit vector epoch time</i> )	393	396	i	4	1	8km/second		
Velocity Vector Y-dot Component ( <i>at the orbit vector epoch time</i> )	397	400	i	4	1	8km/second		
Velocity Vector Z-dot Component ( <i>at the orbit vector epoch time</i> )	401	404	i	4	1	8km/second		
Earth/Sun Distance Ratio ( <i>at the orbit vector epoch time; relative to the mean distance of 1 AU</i> )	405	408	u	4	1	6		
<Zero Fill>	409	424	i	4	4	0		
<b>ANALOG TELEMETRY CONVERSION</b>								
<i>Volts-to-engineering units (e.g., temperature in Celsius) conversion coefficients for the analog telemetry items. (NOTE: 1 count = 0.02 volts.)</i>								
Patch Temperature Conversion Coefficient 1	425	428	i	4	1	6K		
Patch Temperature Conversion Coefficient 2	429	432	i	4	1	6K/volts		
Patch Temperature Conversion Coefficient 3	433	436	i	4	1	7K/volts <sup>2</sup>		

Field Name	Start Octet	End Octet	Data Type	Word Size	Number of Words	Scale Factor	Units	Notes
Patch Temperature Conversion Coefficient 4	437	440	i	4	1	8K/volts <sup>3</sup>		
Patch Temperature Conversion Coefficient 5	441	444	i	4	1	9K/volts <sup>4</sup>		
Patch Temperature Conversion Coefficient 6	445	448	i	4	1	10K/volts <sup>5</sup>		
Patch Temperature Extended Conversion Coefficient 1	449	452	i	4	1	6K		
Patch Temperature Extended Conversion Coefficient 2	453	456	i	4	1	6K/volts		
Patch Temperature Extended Conversion Coefficient 3	457	460	i	4	1	7K/volts <sup>2</sup>		
Patch Temperature Extended Conversion Coefficient 4	461	464	i	4	1	8K/volts <sup>3</sup>		
Patch Temperature Extended Conversion Coefficient 5	465	468	i	4	1	9K/volts <sup>4</sup>		
Patch Temperature Extended Conversion Coefficient 6	469	472	i	4	1	10K/volts <sup>5</sup>		
Patch Power Conversion Coefficient 1	473	476	i	4	1	6mW		
Patch Power Conversion Coefficient 2	477	480	i	4	1	6mW/volts		
Patch Power Conversion Coefficient 3	481	484	i	4	1	7mW/volts <sup>2</sup>		
Patch Power Conversion Coefficient 4	485	488	i	4	1	8mW/volts <sup>3</sup>		
Patch Power Conversion Coefficient 5	489	492	i	4	1	9mW/volts <sup>4</sup>		
Patch Power Conversion Coefficient 6	493	496	i	4	1	10mW/volts <sup>5</sup>		
Radiator Temperature Conversion Coefficient 1	497	500	i	4	1	6K		
Radiator Temperature Conversion Coefficient 2	501	504	i	4	1	6K/volts		
Radiator Temperature Conversion Coefficient 3	505	508	i	4	1	7K/volts <sup>2</sup>		
Radiator Temperature Conversion Coefficient 4	509	512	i	4	1	8K/volts <sup>3</sup>		
Radiator Temperature Conversion Coefficient 5	513	516	i	4	1	9K/volts <sup>4</sup>		
Radiator Temperature Conversion Coefficient 6	517	520	i	4	1	10K/volts <sup>5</sup>		
Blackbody Temperature 1 Conversion Coefficient 1	521	524	i	4	1	6C		
Blackbody Temperature 1 Conversion Coefficient 2	525	528	i	4	1	6C/volts		
Blackbody Temperature 1 Conversion Coefficient 3	529	532	i	4	1	7C/volts <sup>2</sup>		
Blackbody Temperature 1 Conversion Coefficient 4	533	536	i	4	1	8C/volts <sup>3</sup>		
Blackbody Temperature 1 Conversion Coefficient 5	537	540	i	4	1	9C/volts <sup>4</sup>		
Blackbody Temperature 1 Conversion Coefficient 6	541	544	i	4	1	10C/volts <sup>5</sup>		
Blackbody Temperature 2 Conversion Coefficient 1	545	548	i	4	1	6C		
Blackbody Temperature 2 Conversion Coefficient 2	549	552	i	4	1	6C/volts		
Blackbody Temperature 2 Conversion Coefficient 3	553	556	i	4	1	7C/volts <sup>2</sup>		
Blackbody Temperature 2 Conversion Coefficient 4	557	560	i	4	1	8C/volts <sup>3</sup>		
Blackbody Temperature 2 Conversion Coefficient 5	561	564	i	4	1	9C/volts <sup>4</sup>		
Blackbody Temperature 2 Conversion Coefficient 6	565	568	i	4	1	10C/volts <sup>5</sup>		
Blackbody Temperature 3 Conversion Coefficient 1	569	572	i	4	1	6C		
Blackbody Temperature 3 Conversion Coefficient 2	573	576	i	4	1	6C/volts		
Blackbody Temperature 3 Conversion Coefficient 3	577	580	i	4	1	7C/volts <sup>2</sup>		
Blackbody Temperature 3 Conversion Coefficient 4	581	584	i	4	1	8C/volts <sup>3</sup>		
Blackbody Temperature 3 Conversion Coefficient 5	585	588	i	4	1	9C/volts <sup>4</sup>		
Blackbody Temperature 3 Conversion Coefficient 6	589	592	i	4	1	10C/volts <sup>5</sup>		
Blackbody Temperature 4 Conversion Coefficient 1	593	596	i	4	1	6C		
Blackbody Temperature 4 Conversion Coefficient 2	597	600	i	4	1	6C/volts		
Blackbody Temperature 4 Conversion Coefficient 3	601	604	i	4	1	7C/volts <sup>2</sup>		
Blackbody Temperature 4 Conversion Coefficient 4	605	608	i	4	1	8C/volts <sup>3</sup>		
Blackbody Temperature 4 Conversion Coefficient 5	609	612	i	4	1	9C/volts <sup>4</sup>		
Blackbody Temperature 4 Conversion Coefficient 6	613	616	i	4	1	10C/volts <sup>5</sup>		
Electronics Current Conversion Coefficient 1	617	620	i	4	1	6mA		
Electronics Current Conversion Coefficient 2	621	624	i	4	1	6mA/volts		
Electronics Current Conversion Coefficient 3	625	628	i	4	1	7mA/volts <sup>2</sup>		
Electronics Current Conversion Coefficient 4	629	632	i	4	1	8mA/volts <sup>3</sup>		
Electronics Current Conversion Coefficient 5	633	636	i	4	1	9mA/volts <sup>4</sup>		
Electronics Current Conversion Coefficient 6	637	640	i	4	1	10mA/volts <sup>5</sup>		
Motor Current Conversion Coefficient 1	641	644	i	4	1	6mA		
Motor Current Conversion Coefficient 2	645	648	i	4	1	6mA/volts		
Motor Current Conversion Coefficient 3	649	652	i	4	1	7mA/volts <sup>2</sup>		
Motor Current Conversion Coefficient 4	653	656	i	4	1	8mA/volts <sup>3</sup>		

Field Name	Start Octet	End Octet	Data Type	Word Size	Number of Words	Scale Factor	Units	Notes
Motor Current Conversion Coefficient 5	657	660	i	4	1	9mA/volts <sup>4</sup>		
Motor Current Conversion Coefficient 6	661	664	i	4	1	10mA/volts <sup>5</sup>		
Earth Shield Position Conversion Coefficient 1	665	668	i	4	1	6		
Earth Shield Position Conversion Coefficient 2	669	672	i	4	1	6		
Earth Shield Position Conversion Coefficient 3	673	676	i	4	1	7		
Earth Shield Position Conversion Coefficient 4	677	680	i	4	1	8		
Earth Shield Position Conversion Coefficient 5	681	684	i	4	1	9		
Earth Shield Position Conversion Coefficient 6	685	688	i	4	1	10		
Electronics Temperature Conversion Coefficient 1	689	692	i	4	1	6C		
Electronics Temperature Conversion Coefficient 2	693	696	i	4	1	6C/volts		
Electronics Temperature Conversion Coefficient 3	697	700	i	4	1	7C/volts <sup>2</sup>		
Electronics Temperature Conversion Coefficient 4	701	704	i	4	1	8C/volts <sup>3</sup>		
Electronics Temperature Conversion Coefficient 5	705	708	i	4	1	9C/volts <sup>4</sup>		
Electronics Temperature Conversion Coefficient 6	709	712	i	4	1	10C/volts <sup>5</sup>		
Cooler Housing Temperature Conversion Coefficient 1	713	716	i	4	1	6C		
Cooler Housing Temperature Conversion Coefficient 2	717	720	i	4	1	6C/volts		
Cooler Housing Temperature Conversion Coefficient 3	721	724	i	4	1	7C/volts <sup>2</sup>		
Cooler Housing Temperature Conversion Coefficient 4	725	728	i	4	1	8C/volts <sup>3</sup>		
Cooler Housing Temperature Conversion Coefficient 5	729	732	i	4	1	9C/volts <sup>4</sup>		
Cooler Housing Temperature Conversion Coefficient 6	733	736	i	4	1	10C/volts <sup>5</sup>		
Baseplate Temperature Conversion Coefficient 1	737	740	i	4	1	6C		
Baseplate Temperature Conversion Coefficient 2	741	744	i	4	1	6C/volts		
Baseplate Temperature Conversion Coefficient 3	745	748	i	4	1	7C/volts <sup>2</sup>		
Baseplate Temperature Conversion Coefficient 4	749	752	i	4	1	8C/volts <sup>3</sup>		
Baseplate Temperature Conversion Coefficient 5	753	756	i	4	1	9C/volts <sup>4</sup>		
Baseplate Temperature Conversion Coefficient 6	757	760	i	4	1	10C/volts <sup>5</sup>		
Motor Housing Temperature Conversion Coefficient 1	761	764	i	4	1	6C		
Motor Housing Temperature Conversion Coefficient 2	765	768	i	4	1	6C/volts		
Motor Housing Temperature Conversion Coefficient 3	769	772	i	4	1	7C/volts <sup>2</sup>		
Motor Housing Temperature Conversion Coefficient 4	773	776	i	4	1	8C/volts <sup>3</sup>		
Motor Housing Temperature Conversion Coefficient 5	777	780	i	4	1	9C/volts <sup>4</sup>		
Motor Housing Temperature Conversion Coefficient 6	781	784	i	4	1	10C/volts <sup>5</sup>		
A/D Converter Temperature Conversion Coefficient 1	785	788	i	4	1	6C		
A/D Converter Temperature Conversion Coefficient 2	789	792	i	4	1	6C/volts		
A/D Converter Temperature Conversion Coefficient 3	793	796	i	4	1	7C/volts <sup>2</sup>		
A/D Converter Temperature Conversion Coefficient 4	797	800	i	4	1	8C/volts <sup>3</sup>		
A/D Converter Temperature Conversion Coefficient 5	801	804	i	4	1	9C/volts <sup>4</sup>		
A/D Converter Temperature Conversion Coefficient 6	805	808	i	4	1	10C/volts <sup>5</sup>		
Detector #4 Bias Voltage Conversion Coefficient 1	809	812	i	4	1	6		
Detector #4 Bias Voltage Conversion Coefficient 2	813	816	i	4	1	6		
Detector #4 Bias Voltage Conversion Coefficient 3	817	820	i	4	1	7		
Detector #4 Bias Voltage Conversion Coefficient 4	821	824	i	4	1	8		
Detector #4 Bias Voltage Conversion Coefficient 5	825	828	i	4	1	9		
Detector #4 Bias Voltage Conversion Coefficient 6	829	832	i	4	1	10		
Detector #5 Bias Voltage Conversion Coefficient 1	833	836	i	4	1	6		
Detector #5 Bias Voltage Conversion Coefficient 2	837	840	i	4	1	6		
Detector #5 Bias Voltage Conversion Coefficient 3	841	844	i	4	1	7		
Detector #5 Bias Voltage Conversion Coefficient 4	845	848	i	4	1	8		
Detector #5 Bias Voltage Conversion Coefficient 5	849	852	i	4	1	9		
Detector #5 Bias Voltage Conversion Coefficient 6	853	856	i	4	1	10		
Blackbody Temperature, Channel 3B, Conversion Coefficient 1	857	860	i	4	1	6C		
Blackbody Temperature, Channel 3B, Conversion Coefficient 2	861	864	i	4	1	6C/volts		
Blackbody Temperature, Channel 3B, Conversion Coefficient 3	865	868	i	4	1	7C/volts <sup>2</sup>		
Blackbody Temperature, Channel 3B, Conversion Coefficient 4	869	872	i	4	1	8C/volts <sup>3</sup>		
Blackbody Temperature, Channel 3B, Conversion Coefficient 5	873	876	i	4	1	9C/volts <sup>4</sup>		

Field Name	Start Octet	End Octet	Data Type	Word Size	Number of Words	Scale Factor	Units	Notes
Blackbody Temperature, Channel 3B, Conversion Coefficient 6	877	880	i	4	1	10	C/volts <sup>5</sup>	
Blackbody Temperature, Channel 4, Conversion Coefficient 1	881	884	i	4	1	6	C	
Blackbody Temperature, Channel 4, Conversion Coefficient 2	885	888	i	4	1	6	C/volts	
Blackbody Temperature, Channel 4, Conversion Coefficient 3	889	892	i	4	1	7	C/volts <sup>2</sup>	
Blackbody Temperature, Channel 4, Conversion Coefficient 4	893	896	i	4	1	8	C/volts <sup>3</sup>	
Blackbody Temperature, Channel 4, Conversion Coefficient 5	897	900	i	4	1	9	C/volts <sup>4</sup>	
Blackbody Temperature, Channel 4, Conversion Coefficient 6	901	904	i	4	1	10	C/volts <sup>5</sup>	
Blackbody Temperature, Channel 5, Conversion Coefficient 1	905	908	i	4	1	6	C	
Blackbody Temperature, Channel 5, Conversion Coefficient 2	909	912	i	4	1	6	C/volts	
Blackbody Temperature, Channel 5, Conversion Coefficient 3	913	916	i	4	1	7	C/volts <sup>2</sup>	
Blackbody Temperature, Channel 5, Conversion Coefficient 4	917	920	i	4	1	8	C/volts <sup>3</sup>	
Blackbody Temperature, Channel 5, Conversion Coefficient 5	921	924	i	4	1	9	C/volts <sup>4</sup>	
Blackbody Temperature, Channel 5, Conversion Coefficient 6	925	928	i	4	1	10	C/volts <sup>5</sup>	
Reference Voltage Conversion Coefficient 1	929	932	i	4	1	6		
Reference Voltage Conversion Coefficient 2	933	936	i	4	1	6		
Reference Voltage Conversion Coefficient 3	937	940	i	4	1	7		
Reference Voltage Conversion Coefficient 4	941	944	i	4	1	8		
Reference Voltage Conversion Coefficient 5	945	948	i	4	1	9		
Reference Voltage Conversion Coefficient 6	949	952	i	4	1	10		
<b>METOP MANEUVERS IDENTIFICATION</b>								
<i>The fields in this section are Metop specific. For NOAA-originated AVHRR data, these fields are spare (zero fill).</i>								
Start of Maneuver Year (four digits, e.g., 2000)	953	954	u	2	1	0		
Start of Maneuver Day of Year (e.g., 365)	955	956	u	2	1	0		
Start of Maneuver UTC Time of Day	957	960	u	4	1	0	milliseconds	
End of Maneuver Year (four digits, e.g., 2000)	961	962	u	2	1	0		
End of Maneuver Day of Year (e.g., 365)	963	964	u	2	1	0		
End of Maneuver UTC Time of Day	965	968	u	4	1	0	milliseconds	
Change in Spacecraft Velocity ( $\Delta V$ )	969	980	i	4	3	TBD	TBD	
Word 1: TBD								
Word 2: TBD								
Word 3: TBD								
Spacecraft Mass	981	988	u	4	2	TBD	TBD	
Word 1: Mass before maneuver								
Word 2: Mass after maneuver								
<b>FILLER</b>								
<Zero Fill>	989	4608	i	4	905	0		

## 4.2 AVHRR 1b Data Record Format (Full Resolution)

Field Name	Start Octet	End Octet	Data Type	Word Size	Number of Words	Scale Factor	Units	Notes
<b>SCAN LINE INFORMATION</b>								
Scan Line Number ( <i>cumulative, starting with 1; range: 0 - 65,535</i> )	1	2	u	2	1	0		
Scan Line Year ( <i>four digits, e.g., 2000</i> )	3	4	u	2	1	0		
Scan Line Day of Year ( <i>e.g., 365</i> )	5	6	u	2	1	0		
Satellite Clock Drift Delta	7	8	i	2	1	0	milliseconds	
Scan Line UTC Time of Day	9	12	u	4	1	0	milliseconds	
Scan Line Bit Field bit 15: satellite direction (0=northbound; 1=southbound) bit 14: clock drift correction (0=not corrected; 1=scan time corrected for clock drift) bits 13-2: <zero fill> bits 1-0: channel 3 select (0=3B; 1=3A; 2=transition)	13	14	u	2	1	0		
<Zero Fill>	15	24	i	2	5	0		
<b>QUALITY INDICATORS</b>								
Quality Indicator Bit Field ( <i>if a bit is on (=1), the statement is true</i> ) bit 31: do not use scan for product generation bit 30: time sequence error detected within this scan (see below) bit 29: data gap precedes this scan bit 28: insufficient data for calibration (see below) bit 27: earth location data not available (see below) bit 26: first good time following a clock update (nominally 0) bit 25: instrument status changed with this scan bit 24: bit sync dropped lock during frame (NOAA) or <zero fill> (Metop) bit 23: frame sync word has errors (NOAA) or <zero fill> (Metop) bit 22: frame sync returned to lock (NOAA) or <zero fill> (Metop) bit 21: frame sync word not valid (NOAA) or <zero fill> (Metop) bit 20: bit slip occurred during this frame (NOAA) or <zero fill> (Metop) bits 19-9: <zero fill> bit 8: TIP parity error detected (NOAA) or <zero fill> (Metop) bits 7-6: reflected sunlight detected ch 3B (0=no anomaly; 1=anomaly; 3=unsure) bits 5-4: reflected sunlight detected ch 4 (0=no anomaly; 1=anomaly; 3=unsure) bits 3-2: reflected sunlight detected ch 5 (0=no anomaly; 1=anomaly; 3=unsure) bit 1: resync occurred on this frame (NOAA) or <zero fill> (Metop) bit 0: pseudonoise occurred on this frame (NOAA) or <zero fill> (Metop)	25	28	u	4	1	0		
Scan Line Quality Flags [<Reserved>] ( <i>zero fill</i> )	29	29	u	1	1	0		
Scan Line Quality Flags [Time Problem Code] ( <i>If a bit is on (=1), the statement is true. All bits off implies the scan time is as expected.</i> ) bit 7: time field is bad but can probably be inferred from the previous good time bit 6: time field is bad and can't be inferred from the previous good time bit 5: this record starts a sequence that is inconsistent with previous times (i.e., there is a time discontinuity). This may be associated with a spacecraft clock update. (See bit 26, Quality Indicator Bit Field.) bit 4: start of a sequence that apparently repeats scan times that have been previously accepted bits 3-0: <zero fill>	30	30	u	1	1	0		

Field Name	Start Octet	End Octet	Data Type	Word Size	Number of Words	Scale Factor	Units	Notes
<b>Scan Line Quality Flags [Calibration Problem Code]</b> <i>(If a bit is on (=1), the statement is true. These bits complement the channel indicators; all bits set to 0 indicates normal calibration.)</i> bit 7: Scan line not calibrated: all IR channels failed calibration. bit 6: Scan line marginally calibrated: one or more IR channels marginally calibrated OR one or more, but not all, IR channels failed calibration. bit 5: Scan line not calibrated: bad or insufficient PRT data. bit 4: Scan line marginally calibrated: marginal PRT data. bit 3: Some uncalibrated channels for this scan line (i.e., one or more, but not all, IR channels failed calibration). bit 2: No visible calibration due to either the presence of MIRP pseudonoise in place of AVHRR data (NOAA only) or calibration processing turned off. bit 1: <zero fill> bit 0: scan line was not calibrated because of satellite maneuver (Metop) or <zero fill> (NOAA)	31	31	u	1	1	0		
<b>Scan Line Quality Flags [Earth Location Problem Code]</b> <i>(If a bit is on (=1), the statement is true. All bits set to 0 implies the earth location was normal.)</i> bit 7: not earth located because of bad time; earth location fields zero-filled bit 6: earth location questionable: questionable time code (see time problem flags above) bit 5: earth location questionable: marginal agreement with reasonableness check bit 4: earth location questionable: fails reasonableness check bits 3-2: <zero fill> bit 1: not earth located because of satellite in-plane maneuver (Metop) or <zero fill> (NOAA) bit 0: not earth located because of satellite out-of-plane maneuver (Metop) or <zero fill> (NOAA)	32	32	u	1	1	0		
<b>Calibration Quality Flags</b> <i>(all bits off implies a good calibration)</i> <b>Word 1: Channel 3B</b> bits 15-8: <zero fill> bit 7: this channel is not calibrated bit 6: this channel is calibrated but questionable bit 5: all bad blackbody counts for scan line bit 4: all bad space view counts for scan line bit 3: <zero fill> bit 2: marginal blackbody view counts for this line bit 1: marginal space view counts for this line bit 0: <zero fill>  <b>Words 2-3: Channels 4-5 (in order)</b>	33	38	u	2	3	0		
Count of Bit Errors in Frame Sync (NOAA) or <zero fill> (Metop)	39	40	u	2	1	0		
<Zero Fill>	41	48	i	4	2	0		
<b>CALIBRATION COEFFICIENTS</b>								
Visible Operational Cal Ch 1 Slope 1	49	52	i	4	1	7		
Visible Operational Cal Ch 1 Intercept 1	53	56	i	4	1	6		
Visible Operational Cal Ch 1 Slope 2	57	60	i	4	1	7		
Visible Operational Cal Ch 1 Intercept 2	61	64	i	4	1	6		
Visible Operational Cal Ch 1 Intersection	65	68	i	4	1	0		
Visible Test Cal Ch 1 Slope 1	69	72	i	4	1	7		
Visible Test Cal Ch 1 Intercept 1	73	76	i	4	1	6		
Visible Test Cal Ch 1 Slope 2	77	80	i	4	1	7		
Visible Test Cal Ch 1 Intercept 2	81	84	i	4	1	6		
Visible Test Cal Ch 1 Intersection	85	88	i	4	1	0		
Visible Prelaunch Cal Ch 1 Slope 1	89	92	i	4	1	7		

Field Name	Start Octet	End Octet	Data Type	Word Size	Number of Words	Scale Factor	Units	Notes
Visible Prelaunch Cal Ch 1 Intercept 1	93	96	i	4	1	6		
Visible Prelaunch Cal Ch 1 Slope 2	97	100	i	4	1	7		
Visible Prelaunch Cal Ch 1 Intercept 2	101	104	i	4	1	6		
Visible Prelaunch Cal Ch 1 Intersection	105	108	i	4	1	0		
Visible Operational Cal Ch 2 Slope 1	109	112	i	4	1	7		
Visible Operational Cal Ch 2 Intercept 1	113	116	i	4	1	6		
Visible Operational Cal Ch 2 Slope 2	117	120	i	4	1	7		
Visible Operational Cal Ch 2 Intercept 2	121	124	i	4	1	6		
Visible Operational Cal Ch 2 Intersection	125	128	i	4	1	0		
Visible Test Cal Ch 2 Slope 1	129	132	i	4	1	7		
Visible Test Cal Ch 2 Intercept 1	133	136	i	4	1	6		
Visible Test Cal Ch 2 Slope 2	137	140	i	4	1	7		
Visible Test Cal Ch 2 Intercept 2	141	144	i	4	1	6		
Visible Test Cal Ch 2 Intersection	145	148	i	4	1	0		
Visible Prelaunch Cal Ch 2 Slope 1	149	152	i	4	1	7		
Visible Prelaunch Cal Ch 2 Intercept 1	153	156	i	4	1	6		
Visible Prelaunch Cal Ch 2 Slope 2	157	160	i	4	1	7		
Visible Prelaunch Cal Ch 2 Intercept 2	161	164	i	4	1	6		
Visible Prelaunch Cal Ch 2 Intersection	165	168	i	4	1	0		
Visible Operational Cal Ch 3A Slope 1	169	172	i	4	1	7		
Visible Operational Cal Ch 3A Intercept 1	173	176	i	4	1	6		
Visible Operational Cal Ch 3A Slope 2	177	180	i	4	1	7		
Visible Operational Cal Ch 3A Intercept 2	181	184	i	4	1	6		
Visible Operational Cal Ch 3A Intersection	185	188	i	4	1	0		
Visible Test Cal Ch 3A Slope 1	189	192	i	4	1	7		
Visible Test Cal Ch 3A Intercept 1	193	196	i	4	1	6		
Visible Test Cal Ch 3A Slope 2	197	200	i	4	1	7		
Visible Test Cal Ch 3A Intercept 2	201	204	i	4	1	6		
Visible Test Cal Ch 3A Intersection	205	208	i	4	1	0		
Visible Prelaunch Cal Ch 3A Slope 1	209	212	i	4	1	7		
Visible Prelaunch Cal Ch 3A Intercept 1	213	216	i	4	1	6		
Visible Prelaunch Cal Ch 3A Slope 2	217	220	i	4	1	7		
Visible Prelaunch Cal Ch 3A Intercept 2	221	224	i	4	1	6		
Visible Prelaunch Cal Ch 3A Intersection	225	228	i	4	1	0		
IR Operational Cal Ch 3B Coefficient 1	229	232	i	4	1	6		
IR Operational Cal Ch 3B Coefficient 2	233	236	i	4	1	6		
IR Operational Cal Ch 3B Coefficient 3	237	240	i	4	1	6		
IR Test Cal Ch 3B Coefficient 1	241	244	i	4	1	6		
IR Test Cal Ch 3B Coefficient 2	245	248	i	4	1	6		
IR Test Cal Ch 3B Coefficient 3	249	252	i	4	1	6		
IR Operational Cal Ch 4 Coefficient 1	253	256	i	4	1	6		
IR Operational Cal Ch 4 Coefficient 2	257	260	i	4	1	6		
IR Operational Cal Ch 4 Coefficient 3	261	264	i	4	1	7		
IR Test Cal Ch 4 Coefficient 1	265	268	i	4	1	6		
IR Test Cal Ch 4 Coefficient 2	269	272	i	4	1	6		
IR Test Cal Ch 4 Coefficient 3	273	276	i	4	1	7		
IR Operational Cal Ch 5 Coefficient 1	277	280	i	4	1	6		
IR Operational Cal Ch 5 Coefficient 2	281	284	i	4	1	6		
IR Operational Cal Ch 5 Coefficient 3	285	288	i	4	1	7		
IR Test Cal Ch 5 Coefficient 1	289	292	i	4	1	6		
IR Test Cal Ch 5 Coefficient 2	293	296	i	4	1	6		
IR Test Cal Ch 5 Coefficient 3	297	300	i	4	1	7		

Field Name	Start Octet	End Octet	Data Type	Word Size	Number of Words	Scale Factor	Units	Notes
<b>NAVIGATION</b>								
Computed Yaw Steering ( <i>Metop: content defined below</i> ) or <Zero Fill> ( <i>NOAA</i> ) Word 1: Computed roll angle Word 2: Computed pitch angle Word 3: Computed yaw angle	301	306	i	2	3	0	degrees	
Total Applied Attitude Correction Word 1: Roll Word 2: Pitch Word 3: Yaw	307	312	i	2	3	3	degrees	
Navigation Status Bit Field ( <i>bits 20-18 are Metop specific and will contain zero fill for NOAA; bits 11-0 are NOAA specific and will contain zero fill for Metop</i> ) bits 31-21: <zero fill> bit 20-19: yaw steering parameters usage indicator (0=no yaw steering correction; 1=computed parameters from Metop data stream; 2=measured parameters from Metop data stream; 3=computed parameters from AELDS) bit 18: Metop maneuver indicator (0=slew does not occur during a Metop in-plane or out-of-plane maneuver; 1=slew, or some part of it, occurs during a maneuver) bit 17: earth location at the satellite subpoint is accurate and reasonable, i.e., is within tolerance defined by "Nadir Earth Location Tolerance" in header (0=out of tolerance; 1=in tolerance) bit 16: earth location corrected for Euler angles (0=FALSE; 1=TRUE) bits 15-12: earth location indicator (0=earth location available; 1=user ephemeris files greater than 24 hours old; 2=no earth location available) bits 11-8: spacecraft attitude control (0=operating in YGC or NOMINAL mode; 1=operating in another mode; 2=attitude exceeds nominal tolerance; 3=both 1 and 2) bits 7-4: attitude SMODE (0=nominal mode; 1=rate nulling mode; 2=YGC mode; 3=search mode; 4=coast mode) bits 3-0: attitude PWTIP\$AC (0=nominal mode/no test; 1=yaw axis test in progress; 2=roll axis test in progress; 3=pitch axis test in progress)	313	316	u	4	1	0		
Time Associated with Euler Angles	317	320	i	4	1	0	seconds	
Euler Angles ( <i>NOTE: For Metop-originated AVHRR data, this field is also referred to as the measured yaw steering parameters.</i> ) Word 1: Roll Word 2: Pitch Word 3: Yaw	321	326	i	2	3	3	degrees	
Spacecraft Altitude above Reference Ellipsoid	327	328	u	2	1	1	kilometers	
Angular Relationships ( <i>relative azimuth range +/- 180.00 degrees</i> ) Word 1: Solar zenith angle, FOV 25 Word 2: Satellite zenith angle, FOV 25 Word 3: Relative azimuth angle, FOV 25 Word 4: Solar zenith angle, FOV 65 ... (set of 3 angles every 40 FOVs) ... Word 153: Relative azimuth angle, FOV 2025	329	634	i	2	153	2	degrees	
<Zero Fill>	635	640	i	2	3	0		
Earth Location ( <i>north latitude and east longitude are positive</i> ) Word 1: Latitude, FOV 25 Word 2: Longitude, FOV 25 Word 3: Latitude, FOV 65 ... (lat/lon word pair every 40 FOVs) ... Word 102: Longitude, FOV 2025	641	1048	i	4	102	4	degrees	
<Zero Fill>	1049	1056	i	4	2	0		

Field Name	Start Octet	End Octet	Data Type	Word Size	Number of Words	Scale Factor	Units	Notes
<b>FRAME TELEMETRY</b>								
Frame Sync ( <i>The first 60 bits (in 6 10-bit values) from a 63-bit pseudonoise generator starting in the all 1's state. The generator polynomial is: <math>x^6 + x^5 + x^2 + 1</math>.</i> ) (NOAA: content defined below) or <Zero Fill> (Metop) Word 1: 644 Word 2: 367 Word 3: 860 Word 4: 413 Word 5: 527 Word 6: 149	1057	1068	u	2	6	0		
ID (NOAA: content defined below) or <Zero Fill> (Metop) Word 1 bits 15-10: <zero fill> bit 9: MIRP/AVHRR sync (0=internal sync; 1=AVHRR sync) bits 8-7: frame ID (0=GAC frame; 1=HRPT minor frame 1; 2=HRPT minor frame 2; 3=HRPT minor frame 3) bits 6-3: spacecraft address bit 2: resync (0=frame stable; 1=frame resync occurred) bit 1: AVHRR input (0=pseudonoise; 1=normal) bit 0: channel 3 status (0=AVHRR channel 3B; 1=AVHRR channel 3A)  Word 2 bits 15-10: <zero fill> bits 9-0: <undefined>	1069	1072	u	2	2	0		
Time Code (NOAA: content defined below) or <Zero Fill> (Metop) Word 1 bits 15-10: <zero fill> bits 9-1: binary day count bit 0: 0 (zero)  Word 2 bits 15-10: <zero fill> bit 9: 1 (one) bit 8: 0 (zero) bit 7: 1 (one) bits 6-0: most significant part of binary millisecond of day count  Word 3 bits 15-10: <zero fill> bits 9-0: part of binary millisecond of day count  Word 4 bits 15-10: <zero fill> bits 9-0: least significant part of binary millisecond of day count	1073	1080	u	2	4	0		
Ramp Calibration Word 1: Ramp calibration, channel 1 Word 2: Ramp calibration, channel 2 Word 3: Ramp calibration, channel 3 Word 4: Ramp calibration, channel 4 Word 5: Ramp calibration, channel 5	1081	1090	u	2	5	0	counts	
Internal Target Temperature ( <i>Three readings from one of the four platinum resistance thermometers (PRT). A different PRT is sampled for each scan. Every fifth scan will contain a reference value of 0 in place of each reading.</i> ) Word 1: PRT reading 1 Word 2: PRT reading 2 Word 3: PRT reading 3	1091	1096	u	2	3	0	counts	1
Patch Temperature	1097	1098	u	2	1	0	counts	1
<Undefined> (NOAA) or <Zero Fill> (Metop)	1099	1100	u	2	1	0		

Field Name	Start Octet	End Octet	Data Type	Word Size	Number of Words	Scale Factor	Units	Notes
Back Scan ( <i>Ten samples of calibration target view data from each of AVHRR channels 3, 4, and 5.</i> ) Word 1: channel 3, sample 1 Word 2: channel 4, sample 1 Word 3: channel 5, sample 1 Word 4: channel 3, sample 2 ... Word 30: channel 5, sample 10	1101	1160	u	2	30	0	counts	1
Space Data ( <i>Ten samples of space view data from each of AVHRR channels 1, 2, 3, 4, and 5.</i> ) Word 1: channel 1, sample 1 Word 2: channel 2, sample 1 ... Word 5: channel 5, sample 1 Word 6: channel 1, sample 2 ... Word 50: channel 5, sample 10	1161	1260	u	2	50	0	counts	
Sync Delta ( <i>NOAA: content defined below</i> ) or <Zero Fill> ( <i>Metop</i> ) bits 15-10: <zero fill> bit 9: AVHRR sync (0=early; 1=late) bits 8-0: 9-bit binary count of 0.9984 MHz periods	1261	1262	u	2	1	0		
<Zero Fill>	1263	1264	i	2	1	0		
<b>EARTH OBSERVATIONS</b>								
Earth Data Word 1 bits 31-30: <zero fill> bits 29-20: channel 1, FOV 1 bits 19-10: channel 2, FOV 1 bits 9-0: channel 3, FOV 1  Word 2 bits 31-30: <zero fill> bits 29-20: channel 4, FOV 1 bits 19-10: channel 5, FOV 1 bits 9-0: channel 1, FOV 2 ... Word 3414 bits 31-30: <zero fill> bits 29-20: channel 5, FOV 2048 bits 19-0: <zero fill>	1265	14920	u	4	3414	0	counts	
<Zero Fill>	14921	14928	i	4	2	0		
<b>DIGITAL B HOUSEKEEPING TELEMETRY</b>								
Digital B Telemetry Update Flags ( <i>If bit = 0, associated telemetry item is up-to-date. If bit = 1, associated telemetry item was not updated during most recent telemetry cycle - possibly due to lost frame.</i> ) bit 15: scan motor/telemetry status bit 14: electronics/telemetry status bit 13: channel 1 status bit 12: channel 2 status bit 11: channel 3A status bit 10: channel 3B status bit 9: channel 4 status bit 8: channel 5 status bit 7: channel 3A/3B select status bit 6: voltage calibration status bit 5: cooler heat status bit 4: scan motor mode status bit 3: telemetry lock status bit 2: earth shield status bit 1: patch control status bit 0: <zero fill>	14929	14930	u	2	1	0		

Field Name	Start Octet	End Octet	Data Type	Word Size	Number of Words	Scale Factor	Units	Notes
<b>VHRR Digital B Data</b> bit 15: scan motor/telemetry status (0=off; 1=on) bit 14: electronics/telemetry status (0=off; 1=on) bit 13: channel 1 status (0=disable; 1=enable) bit 12: channel 2 status (0=disable; 1=enable) bit 11: channel 3A status (0=disable; 1=enable) bit 10: channel 3B status (0=disable; 1=enable) bit 9: channel 4 status (0=disable; 1=enable) bit 8: channel 5 status (0=disable; 1=enable) bit 7: channel 3A/3B select status (0=3B; 1=3A) bit 6: voltage calibration status (0=off; 1=on) bit 5: cooler heat status (0=off; 1=on) bit 4: scan motor mode status (0=low; 1=high) bit 3: telemetry lock status (0=not locked on; 1=locked on) bit 2: earth shield status (0=disable; 1=deploy) bit 1: patch control status (0=off; 1=on) bit 0: <zero fill>	14931	14932	u	2	1	0		
<Zero Fill>	14933	14944	i	4	3	0		
<b>ANALOG HOUSEKEEPING TELEMETRY</b>								
Analog Telemetry Update Flags ( <i>If bit = 0, associated telemetry item is up-to-date. If bit = 1, associated telemetry item was not updated during most recent telemetry cycle - possibly due to lost frame.</i> ) bits 31-23: <zero fill> bit 22: motor current bit 21: electronics current bit 20: blackbody temperature, channel 5 bit 19: detector #5 bias voltage bit 18: blackbody temperature, channel 4 bit 17: blackbody temperature, channel 3B bit 16: A/D converter temperature bit 15: blackbody temperature 4 bit 14: blackbody temperature 3 bit 13: blackbody temperature 2 bit 12: blackbody temperature 1 bit 11: motor housing temperature bit 10: baseplate temperature bit 9: electronics temperature bit 8: cooler housing temperature bit 7: radiator temperature bit 6: patch temperature bit 5: earth shield position bit 4: patch temperature extended bit 3: detector #4 bias voltage bit 2: reference voltage bit 1: patch power bit 0: <zero fill>	14945	14948	u	4	1	0		
Patch Temperature ( <i>range: 0 - 255</i> )	14949	14949	u	1	1	0	counts	
Patch Temperature Extended ( <i>range: 0 - 255</i> )	14950	14950	u	1	1	0	counts	
Patch Power ( <i>range: 0 - 255</i> )	14951	14951	u	1	1	0	counts	
Radiator Temperature ( <i>range: 0 - 255</i> )	14952	14952	u	1	1	0	counts	
Black Body Temperature 1 ( <i>range: 0 - 255</i> )	14953	14953	u	1	1	0	counts	
Black Body Temperature 2 ( <i>range: 0 - 255</i> )	14954	14954	u	1	1	0	counts	
Black Body Temperature 3 ( <i>range: 0 - 255</i> )	14955	14955	u	1	1	0	counts	
Black Body Temperature 4 ( <i>range: 0 - 255</i> )	14956	14956	u	1	1	0	counts	
Electronics Current ( <i>range: 0 - 255</i> )	14957	14957	u	1	1	0	counts	
Motor Current ( <i>range: 0 - 255</i> )	14958	14958	u	1	1	0	counts	
Earth Shield Position ( <i>range: 0 - 255</i> )	14959	14959	u	1	1	0	counts	
Electronics Temperature ( <i>range: 0 - 255</i> )	14960	14960	u	1	1	0	counts	
Cooler Housing Temperature ( <i>range: 0 - 255</i> )	14961	14961	u	1	1	0	counts	
Baseplate Temperature ( <i>range: 0 - 255</i> )	14962	14962	u	1	1	0	counts	
Motor Housing Temperature ( <i>range: 0 - 255</i> )	14963	14963	u	1	1	0	counts	

Field Name	Start Octet	End Octet	Data Type	Word Size	Number of Words	Scale Factor	Units	Notes
A/D Converter Temperature ( <i>range: 0 - 255</i> )	14964	14964	u	1	1	0	counts	
Detector #4 Bias Voltage ( <i>range: 0 - 255</i> )	14965	14965	u	1	1	0	counts	
Detector #5 Bias Voltage ( <i>range: 0 - 255</i> )	14966	14966	u	1	1	0	counts	
Blackbody Temperature, Channel 3B ( <i>range: 0 - 255</i> )	14967	14967	u	1	1	0	counts	
Blackbody Temperature, Channel 4 ( <i>range: 0 - 255</i> )	14968	14968	u	1	1	0	counts	
Blackbody Temperature, Channel 5 ( <i>range: 0 - 255</i> )	14969	14969	u	1	1	0	counts	
Reference Voltage ( <i>range: 0 - 255</i> )	14970	14970	u	1	1	0	counts	
<Zero Fill>	14971	14976	i	2	3	0		
<b>CLOUDS FROM AVHRR (CLAVR)</b>								
<Reserved> [CLAVR Status Bit Field] bits 31-1: <undefined> bit 0: CLAVR status (0=disable, CCM codes zero-filled; 1=enable)	14977	14980	u	4	1	0		
<Reserved> [CLAVR]	14981	14984	u	4	1	0		
<Reserved> [CLAVR CCM (Clear/Cloudy/Mixed) Codes (0=clear; 1=mixed clear; 2=mixed cloudy; 3=cloudy)] Word 1 bits 15-14: CCM code, FOV 1 bits 13-12: CCM code, FOV 2 ... bits 1-0: CCM code, FOV 8  Word 2 bits 15-14: CCM code, FOV 9 ... bits 1-0: CCM code, FOV 16  ... (set of 8 CCM codes per word) ...  Word 256 bits 15-14: CCM code, FOV 2041 ... bits 1-0: CCM code, FOV 2048	14985	15496	u	2	256	0		
<b>FILLER</b>								
<Zero Fill>	15497	15872	i	4	94	0		

### 4.3 AVHRR 1b Data Record Format (Reduced Resolution)

Field Name	Start Octet	End Octet	Data Type	Word Size	Number of Words	Scale Factor	Units	Notes
<b>SCAN LINE INFORMATION</b>								
Scan Line Number ( <i>cumulative, starting with 1; range: 0 - 65,535</i> )	1	2	u	2	1	0		
Scan Line Year ( <i>four digits, e.g., 2000</i> )	3	4	u	2	1	0		
Scan Line Day of Year ( <i>e.g., 365</i> )	5	6	u	2	1	0		
Satellite Clock Drift Delta	7	8	i	2	1	0	milliseconds	
Scan Line UTC Time of Day	9	12	u	4	1	0	milliseconds	
Scan Line Bit Field bit 15: satellite direction (0=northbound; 1=southbound) bit 14: clock drift correction (0=not corrected; 1=scan time corrected for clock drift) bits 13-2: <zero fill> bits 1-0: channel 3 select (0=3B; 1=3A; 2=transition)	13	14	u	2	1	0		
<Zero Fill>	15	24	i	2	5	0		
<b>QUALITY INDICATORS</b>								
Quality Indicator Bit Field ( <i>if a bit is on (=1), the statement is true</i> ) bit 31: do not use scan for product generation bit 30: time sequence error detected within this scan (see below) bit 29: data gap precedes this scan bit 28: insufficient data for calibration (see below) bit 27: earth location data not available (see below) bit 26: first good time following a clock update (nominally 0) bit 25: instrument status changed with this scan bit 24: bit sync dropped lock during frame (NOAA) or <zero fill> (Metop) bit 23: frame sync word has errors (NOAA) or <zero fill> (Metop) bit 22: frame sync returned to lock (NOAA) or <zero fill> (Metop) bit 21: frame sync word not valid (NOAA) or <zero fill> (Metop) bit 20: bit slip occurred during this frame (NOAA) or <zero fill> (Metop) bits 19-9: <zero fill> bit 8: TIP parity error detected (NOAA) or <zero fill> (Metop) bits 7-6: reflected sunlight detected ch 3B (0=no anomaly; 1=anomaly; 3=unsure) bits 5-4: reflected sunlight detected ch 4 (0=no anomaly; 1=anomaly; 3=unsure) bits 3-2: reflected sunlight detected ch 5 (0=no anomaly; 1=anomaly; 3=unsure) bit 1: resync occurred on this frame (NOAA) or <zero fill> (Metop) bit 0: pseudonoise occurred on this frame (NOAA) or <zero fill> (Metop)	25	28	u	4	1	0		
Scan Line Quality Flags [ <b>&lt;Reserved&gt;</b> ] ( <i>zero fill</i> )	29	29	u	1	1	0		
Scan Line Quality Flags [Time Problem Code] ( <i>If a bit is on (=1), the statement is true. All bits off implies the scan time is as expected.</i> ) bit 7: time field is bad but can probably be inferred from the previous good time bit 6: time field is bad and can't be inferred from the previous good time bit 5: this record starts a sequence that is inconsistent with previous times (i.e., there is a time discontinuity). This may be associated with a spacecraft clock update. (See bit 26, Quality Indicator Bit Field.) bit 4: start of a sequence that apparently repeats scan times that have been previously accepted bits 3-0: <zero fill>	30	30	u	1	1	0		

Field Name	Start Octet	End Octet	Data Type	Word Size	Number of Words	Scale Factor	Units	Notes
<b>Scan Line Quality Flags [Calibration Problem Code]</b> <i>(If a bit is on (=1), the statement is true. These bits complement the channel indicators; all bits set to 0 indicates normal calibration.)</i> bit 7: Scan line not calibrated: all IR channels failed calibration. bit 6: Scan line marginally calibrated: one or more IR channels marginally calibrated OR one or more, but not all, IR channels failed calibration. bit 5: Scan line not calibrated: bad or insufficient PRT data. bit 4: Scan line marginally calibrated: marginal PRT data. bit 3: Some uncalibrated channels for this scan line (i.e., one or more, but not all, IR channels failed calibration). bit 2: No visible calibration due to either the presence of MIRP pseudonoise in place of AVHRR data (NOAA only) or calibration processing turned off. bit 1: <zero fill> bit 0: scan line was not calibrated because of satellite maneuver (Metop) or <zero fill> (NOAA)	31	31	u	1	1	0		
<b>Scan Line Quality Flags [Earth Location Problem Code]</b> <i>(If a bit is on (=1), the statement is true. All bits set to 0 implies the earth location was normal.)</i> bit 7: not earth located because of bad time; earth location fields zero-filled bit 6: earth location questionable: questionable time code (see time problem flags above) bit 5: earth location questionable: marginal agreement with reasonableness check bit 4: earth location questionable: fails reasonableness check bits 3-2: <zero fill> bit 1: not earth located because of satellite in-plane maneuver (Metop) or <zero fill> (NOAA) bit 0: not earth located because of satellite out-of-plane maneuver (Metop) or <zero fill> (NOAA)	32	32	u	1	1	0		
<b>Calibration Quality Flags</b> <i>(all bits off implies a good calibration)</i> <b>Word 1: Channel 3B</b> bits 15-8: <zero fill> bit 7: this channel is not calibrated bit 6: this channel is calibrated but questionable bit 5: all bad blackbody counts for scan line bit 4: all bad space view counts for scan line bit 3: <zero fill> bit 2: marginal blackbody view counts for this line bit 1: marginal space view counts for this line bit 0: <zero fill>  <b>Words 2-3: Channels 4-5 (in order)</b>	33	38	u	2	3	0		
Count of Bit Errors in Frame Sync (NOAA) or <zero fill> (Metop)	39	40	u	2	1	0		
<Zero Fill>	41	48	i	4	2	0		
<b>CALIBRATION COEFFICIENTS</b>								
Visible Operational Cal Ch 1 Slope 1	49	52	i	4	1	7		
Visible Operational Cal Ch 1 Intercept 1	53	56	i	4	1	6		
Visible Operational Cal Ch 1 Slope 2	57	60	i	4	1	7		
Visible Operational Cal Ch 1 Intercept 2	61	64	i	4	1	6		
Visible Operational Cal Ch 1 Intersection	65	68	i	4	1	0		
Visible Test Cal Ch 1 Slope 1	69	72	i	4	1	7		
Visible Test Cal Ch 1 Intercept 1	73	76	i	4	1	6		
Visible Test Cal Ch 1 Slope 2	77	80	i	4	1	7		
Visible Test Cal Ch 1 Intercept 2	81	84	i	4	1	6		
Visible Test Cal Ch 1 Intersection	85	88	i	4	1	0		
Visible Prelaunch Cal Ch 1 Slope 1	89	92	i	4	1	7		

Field Name	Start Octet	End Octet	Data Type	Word Size	Number of Words	Scale Factor	Units	Notes
Visible Prelaunch Cal Ch 1 Intercept 1	93	96	i	4	1	6		
Visible Prelaunch Cal Ch 1 Slope 2	97	100	i	4	1	7		
Visible Prelaunch Cal Ch 1 Intercept 2	101	104	i	4	1	6		
Visible Prelaunch Cal Ch 1 Intersection	105	108	i	4	1	0		
Visible Operational Cal Ch 2 Slope 1	109	112	i	4	1	7		
Visible Operational Cal Ch 2 Intercept 1	113	116	i	4	1	6		
Visible Operational Cal Ch 2 Slope 2	117	120	i	4	1	7		
Visible Operational Cal Ch 2 Intercept 2	121	124	i	4	1	6		
Visible Operational Cal Ch 2 Intersection	125	128	i	4	1	0		
Visible Test Cal Ch 2 Slope 1	129	132	i	4	1	7		
Visible Test Cal Ch 2 Intercept 1	133	136	i	4	1	6		
Visible Test Cal Ch 2 Slope 2	137	140	i	4	1	7		
Visible Test Cal Ch 2 Intercept 2	141	144	i	4	1	6		
Visible Test Cal Ch 2 Intersection	145	148	i	4	1	0		
Visible Prelaunch Cal Ch 2 Slope 1	149	152	i	4	1	7		
Visible Prelaunch Cal Ch 2 Intercept 1	153	156	i	4	1	6		
Visible Prelaunch Cal Ch 2 Slope 2	157	160	i	4	1	7		
Visible Prelaunch Cal Ch 2 Intercept 2	161	164	i	4	1	6		
Visible Prelaunch Cal Ch 2 Intersection	165	168	i	4	1	0		
Visible Operational Cal Ch 3A Slope 1	169	172	i	4	1	7		
Visible Operational Cal Ch 3A Intercept 1	173	176	i	4	1	6		
Visible Operational Cal Ch 3A Slope 2	177	180	i	4	1	7		
Visible Operational Cal Ch 3A Intercept 2	181	184	i	4	1	6		
Visible Operational Cal Ch 3A Intersection	185	188	i	4	1	0		
Visible Test Cal Ch 3A Slope 1	189	192	i	4	1	7		
Visible Test Cal Ch 3A Intercept 1	193	196	i	4	1	6		
Visible Test Cal Ch 3A Slope 2	197	200	i	4	1	7		
Visible Test Cal Ch 3A Intercept 2	201	204	i	4	1	6		
Visible Test Cal Ch 3A Intersection	205	208	i	4	1	0		
Visible Prelaunch Cal Ch 3A Slope 1	209	212	i	4	1	7		
Visible Prelaunch Cal Ch 3A Intercept 1	213	216	i	4	1	6		
Visible Prelaunch Cal Ch 3A Slope 2	217	220	i	4	1	7		
Visible Prelaunch Cal Ch 3A Intercept 2	221	224	i	4	1	6		
Visible Prelaunch Cal Ch 3A Intersection	225	228	i	4	1	0		
IR Operational Cal Ch 3B Coefficient 1	229	232	i	4	1	6		
IR Operational Cal Ch 3B Coefficient 2	233	236	i	4	1	6		
IR Operational Cal Ch 3B Coefficient 3	237	240	i	4	1	6		
IR Test Cal Ch 3B Coefficient 1	241	244	i	4	1	6		
IR Test Cal Ch 3B Coefficient 2	245	248	i	4	1	6		
IR Test Cal Ch 3B Coefficient 3	249	252	i	4	1	6		
IR Operational Cal Ch 4 Coefficient 1	253	256	i	4	1	6		
IR Operational Cal Ch 4 Coefficient 2	257	260	i	4	1	6		
IR Operational Cal Ch 4 Coefficient 3	261	264	i	4	1	7		
IR Test Cal Ch 4 Coefficient 1	265	268	i	4	1	6		
IR Test Cal Ch 4 Coefficient 2	269	272	i	4	1	6		
IR Test Cal Ch 4 Coefficient 3	273	276	i	4	1	7		
IR Operational Cal Ch 5 Coefficient 1	277	280	i	4	1	6		
IR Operational Cal Ch 5 Coefficient 2	281	284	i	4	1	6		
IR Operational Cal Ch 5 Coefficient 3	285	288	i	4	1	7		
IR Test Cal Ch 5 Coefficient 1	289	292	i	4	1	6		
IR Test Cal Ch 5 Coefficient 2	293	296	i	4	1	6		
IR Test Cal Ch 5 Coefficient 3	297	300	i	4	1	7		

Field Name	Start Octet	End Octet	Data Type	Word Size	Number of Words	Scale Factor	Units	Notes
<b>NAVIGATION</b>								
Computed Yaw Steering ( <i>Metop: content defined below</i> ) or <Zero Fill> (NOAA) Word 1: Computed roll angle Word 2: Computed pitch angle Word 3: Computed yaw angle	301	306	i	2	3	0	degrees	
Total Applied Attitude Correction Word 1: Roll Word 2: Pitch Word 3: Yaw	307	312	i	2	3	3	degrees	
Navigation Status Bit Field ( <i>bits 20-18 are Metop specific and will contain zero fill for NOAA; bits 17-0 are NOAA specific and will contain zero fill for Metop</i> ) ? bits 31-21: <zero fill> bit 20-19: yaw steering parameters usage indicator (0=no yaw steering correction; 1=computed parameters from Metop data stream; 2=measured parameters from Metop data stream; 3=computed parameters from AELDS) bit 18: Metop maneuver indicator (0=scan does not occur during a Metop in-plane or out-of-plane maneuver; 1=scan, or some part of it, occurs during a maneuver) bit 17: earth location at the satellite subpoint is accurate and reasonable, i.e., is within tolerance defined by "Nadir Earth Location Tolerance" in header (0=out of tolerance; 1=in tolerance) bit 16: earth location corrected for Euler angles (0=FALSE; 1=TRUE) bits 15-12: earth location indicator (0=earth location available; 1=user ephemeris files greater than 24 hours old; 2=no earth location available) bits 11-8: spacecraft attitude control (0=operating in YGC or NOMINAL mode; 1=operating in another mode; 2=attitude exceeds nominal tolerance; 3=both 1 and 2) bits 7-4: attitude SMODE (0=nominal mode; 1=rate nulling mode; 2=YGC mode; 3=search mode; 4=coast mode) bits 3-0: attitude PWTIP\$AC (0=nominal mode/no test; 1=yaw axis test in progress; 2=roll axis test in progress; 3=pitch axis test in progress)	313	316	u	4	1	0		
Time Associated with Euler Angles	317	320	i	4	1	0	seconds	
Euler Angles ( <i>NOTE: For Metop-originated AVHRR data, this field is also referred to as the measured yaw steering parameters.</i> ) Word 1: Roll Word 2: Pitch Word 3: Yaw	321	326	i	2	3	3	degrees	
Spacecraft Altitude above Reference Ellipsoid	327	328	u	2	1	1	kilometers	
Angular Relationships ( <i>relative azimuth range +/- 180.00 degrees</i> ) Word 1: Solar zenith angle, FOV 5 Word 2: Satellite zenith angle, FOV 5 Word 3: Relative azimuth angle, FOV 5 Word 4: Solar zenith angle, FOV 13 ... (set of 3 angles every 8 FOVs) ... Word 153: Relative azimuth angle, FOV 405	329	634	i	2	153	2	degrees	
<Zero Fill>	635	640	i	2	3	0		
Earth Location ( <i>north latitude and east longitude are positive</i> ) Word 1: Latitude, FOV 5 Word 2: Longitude, FOV 5 Word 3: Latitude, FOV 13 ... (lat/lon word pair every 8 FOVs) ... Word 102: Longitude, FOV 405	641	1048	i	4	102	4	degrees	
<Zero Fill>	1049	1056	i	4	2	0		

Field Name	Start Octet	End Octet	Data Type	Word Size	Number of Words	Scale Factor	Units	Notes
<b>FRAME TELEMETRY</b>								
Frame Sync ( <i>The first 60 bits (in 6 10-bit values) from a 63-bit pseudonoise generator starting in the all 1's state. The generator polynomial is: <math>x^6 + x^5 + x^2 + 1</math>.</i> ) (NOAA: content defined below) or <Zero Fill> (Metop) Word 1: 644 Word 2: 367 Word 3: 860 Word 4: 413 Word 5: 527 Word 6: 149	1057	1068	u	2	6	0		
ID (NOAA: content defined below) or <Zero Fill> (Metop) Word 1 bits 15-10: <zero fill> bit 9: MIRP/AVHRR sync (0=internal sync; 1=AVHRR sync) bits 8-7: frame ID (0=GAC frame; 1=HRPT minor frame 1; 2=HRPT minor frame 2; 3=HRPT minor frame 3) bits 6-3: spacecraft address bit 2: resync (0=frame stable; 1=frame resync occurred) bit 1: AVHRR input (0=pseudonoise; 1=normal) bit 0: channel 3 status (0=AVHRR channel 3B; 1=AVHRR channel 3A)  Word 2 bits 15-10: <zero fill> bits 9-0: <undefined>	1069	1072	u	2	2	0		
Time Code (NOAA: content defined below) or <Zero Fill> (Metop) Word 1 bits 15-10: <zero fill> bits 9-1: binary day count bit 0: 0 (zero)  Word 2 bits 15-10: <zero fill> bit 9: 1 (one) bit 8: 0 (zero) bit 7: 1 (one) bits 6-0: most significant part of binary millisecond of day count  Word 3 bits 15-10: <zero fill> bits 9-0: part of binary millisecond of day count  Word 4 bits 15-10: <zero fill> bits 9-0: least significant part of binary millisecond of day count	1073	1080	u	2	4	0		
Ramp Calibration Word 1: Ramp calibration, channel 1 Word 2: Ramp calibration, channel 2 Word 3: Ramp calibration, channel 3 Word 4: Ramp calibration, channel 4 Word 5: Ramp calibration, channel 5	1081	1090	u	2	5	0	counts	
Internal Target Temperature ( <i>Three readings from one of the four platinum resistance thermometers (PRT). A different PRT is sampled for each scan. Every fifth scan will contain a reference value of 0 in place of each reading.</i> ) Word 1: PRT reading 1 Word 2: PRT reading 2 Word 3: PRT reading 3	1091	1096	u	2	3	0	counts	1
Batch Temperature	1097	1098	u	2	1	0	counts	1
<Undefined> (NOAA) or <Zero Fill> (Metop)	1099	1100	u	2	1	0		

Field Name	Start Octet	End Octet	Data Type	Word Size	Number of Words	Scale Factor	Units	Notes
Back Scan ( <i>Ten samples of calibration target view data from each of AVHRR channels 3, 4, and 5.</i> ) Word 1: channel 3, sample 1 Word 2: channel 4, sample 1 Word 3: channel 5, sample 1 Word 4: channel 3, sample 2 ... Word 30: channel 5, sample 10	1101	1160	u	2	30	0	counts	1
Space Data ( <i>Ten samples of space view data from each of AVHRR channels 1, 2, 3, 4, and 5.</i> ) Word 1: channel 1, sample 1 Word 2: channel 2, sample 1 ... Word 5: channel 5, sample 1 Word 6: channel 1, sample 2 ... Word 50: channel 5, sample 10	1161	1260	u	2	50	0	counts	
Sync Delta ( <i>NOAA: content defined below</i> ) or <Zero Fill> ( <i>Metop</i> ) bits 15-10: <zero fill> bit 9: AVHRR sync (0=early; 1=late) bits 8-0: 9-bit binary count of 0.9984 MHz periods	1261	1262	u	2	1	0		
<Zero Fill>	1263	1264	i	2	1	0		
<b>EARTH OBSERVATIONS</b>								
Earth Data Word 1 bits 31-30: <zero fill> bits 29-20: channel 1, FOV 1 bits 19-10: channel 2, FOV 1 bits 9-0: channel 3, FOV 1  Word 2 bits 31-30: <zero fill> bits 29-20: channel 4, FOV 1 bits 19-10: channel 5, FOV 1 bits 9-0: channel 1, FOV 2 ... Word 682 bits 31-30: <zero fill> bits 29-20: channel 4, FOV 409 bits 19-10: channel 5, FOV 409 bits 9-0: <zero fill>	1265	3992	u	4	682	0	counts	
<Zero Fill>	3993	4000	i	4	2	0		
<b>DIGITAL B HOUSEKEEPING TELEMETRY</b>								
Digital B Telemetry Update Flags ( <i>If bit = 0, associated telemetry item is up-to-date. If bit = 1, associated telemetry item was not updated during most recent telemetry cycle - possibly due to lost frame.</i> ) bit 15: scan motor/telemetry status bit 14: electronics/telemetry status bit 13: channel 1 status bit 12: channel 2 status bit 11: channel 3A status bit 10: channel 3B status bit 9: channel 4 status bit 8: channel 5 status bit 7: channel 3A/3B select status bit 6: voltage calibration status bit 5: cooler heat status bit 4: scan motor mode status bit 3: telemetry lock status bit 2: earth shield status bit 1: patch control status bit 0: <zero fill>	4001	4002	u	2	1	0		

Field Name	Start Octet	End Octet	Data Type	Word Size	Number of Words	Scale Factor	Units	Notes
<b>AVHRR Digital B Data</b>	4003	4004	u	2	1	0		
bit 15: scan motor/telemetry status (0=off; 1=on)								
bit 14: electronics/telemetry status (0=off; 1=on)								
bit 13: channel 1 status (0=disable; 1=enable)								
bit 12: channel 2 status (0=disable; 1=enable)								
bit 11: channel 3A status (0=disable; 1=enable)								
bit 10: channel 3B status (0=disable; 1=enable)								
bit 9: channel 4 status (0=disable; 1=enable)								
bit 8: channel 5 status (0=disable; 1=enable)								
bit 7: channel 3A/3B select status (0=3B; 1=3A)								
bit 6: voltage calibration status (0=off; 1=on)								
bit 5: cooler heat status (0=off; 1=on)								
bit 4: scan motor mode status (0=low; 1=high)								
bit 3: telemetry lock status (0=not locked on; 1=locked on)								
bit 2: earth shield status (0=disable; 1=deploy)								
bit 1: patch control status (0=off; 1=on)								
bit 0: <zero fill>								
<Zero Fill>	4005	4016	i	4	3	0		
<b>ANALOG HOUSEKEEPING TELEMETRY</b>								
Analog Telemetry Update Flags ( <i>If bit = 0, associated telemetry item is up-to-date. If bit = 1, associated telemetry item was not updated during most recent telemetry cycle - possibly due to lost frame.</i> )	4017	4020	u	4	1	0		
bits 31-23: <zero fill>								
bit 22: motor current								
bit 21: electronics current								
bit 20: blackbody temperature, channel 5								
bit 19: detector #5 bias voltage								
bit 18: blackbody temperature, channel 4								
bit 17: blackbody temperature, channel 3B								
bit 16: A/D converter temperature								
bit 15: blackbody temperature 4								
bit 14: blackbody temperature 3								
bit 13: blackbody temperature 2								
bit 12: blackbody temperature 1								
bit 11: motor housing temperature								
bit 10: baseplate temperature								
bit 9: electronics temperature								
bit 8: cooler housing temperature								
bit 7: radiator temperature								
bit 6: patch temperature								
bit 5: earth shield position								
bit 4: patch temperature extended								
bit 3: detector #4 bias voltage								
bit 2: reference voltage								
bit 1: patch power								
bit 0: <zero fill>								
Patch Temperature ( <i>range: 0 - 255</i> )	4021	4021	u	1	1	0	counts	
Patch Temperature Extended ( <i>range: 0 - 255</i> )	4022	4022	u	1	1	0	counts	
Patch Power ( <i>range: 0 - 255</i> )	4023	4023	u	1	1	0	counts	
Radiator Temperature ( <i>range: 0 - 255</i> )	4024	4024	u	1	1	0	counts	
Black Body Temperature 1 ( <i>range: 0 - 255</i> )	4025	4025	u	1	1	0	counts	
Black Body Temperature 2 ( <i>range: 0 - 255</i> )	4026	4026	u	1	1	0	counts	
Black Body Temperature 3 ( <i>range: 0 - 255</i> )	4027	4027	u	1	1	0	counts	
Black Body Temperature 4 ( <i>range: 0 - 255</i> )	4028	4028	u	1	1	0	counts	
Electronics Current ( <i>range: 0 - 255</i> )	4029	4029	u	1	1	0	counts	
Motor Current ( <i>range: 0 - 255</i> )	4030	4030	u	1	1	0	counts	
Earth Shield Position ( <i>range: 0 - 255</i> )	4031	4031	u	1	1	0	counts	
Electronics Temperature ( <i>range: 0 - 255</i> )	4032	4032	u	1	1	0	counts	
Cooler Housing Temperature ( <i>range: 0 - 255</i> )	4033	4033	u	1	1	0	counts	
Baseplate Temperature ( <i>range: 0 - 255</i> )	4034	4034	u	1	1	0	counts	
Motor Housing Temperature ( <i>range: 0 - 255</i> )	4035	4035	u	1	1	0	counts	

Field Name	Start Octet	End Octet	Data Type	Word Size	Number of Words	Scale Factor	Units	Notes
A/D Converter Temperature ( <i>range: 0 - 255</i> )	4036	4036	u	1	1	0	counts	
Detector #4 Bias Voltage ( <i>range: 0 - 255</i> )	4037	4037	u	1	1	0	counts	
Detector #5 Bias Voltage ( <i>range: 0 - 255</i> )	4038	4038	u	1	1	0	counts	
Blackbody Temperature, Channel 3B ( <i>range: 0 - 255</i> )	4039	4039	u	1	1	0	counts	
Blackbody Temperature, Channel 4 ( <i>range: 0 - 255</i> )	4040	4040	u	1	1	0	counts	
Blackbody Temperature, Channel 5 ( <i>range: 0 - 255</i> )	4041	4041	u	1	1	0	counts	
Reference Voltage ( <i>range: 0 - 255</i> )	4042	4042	u	1	1	0	counts	
<Zero Fill>	4043	4048	i	2	3	0		
<b>CLOUDS FROM AVHRR (CLAVR)</b>								
<Reserved> [CLAVR Status Bit Field] bits 31-1: <undefined> bit 0: CLAVR status (0=disable, CCM codes zero-filled; 1=enable)	4049	4052	u	4	1	0		
<Reserved> [CLAVR]	4053	4056	u	4	1	0		
<Reserved> [CLAVR CCM (Clear/Cloudy/Mixed) Codes (0=clear; 1=mixed clear; 2=mixed cloudy; 3=cloudy)] Word 1 bits 15-14: CCM code, FOV 1 bits 13-12: CCM code, FOV 2 ... bits 1-0: CCM code, FOV 8  Word 2 bits 15-14: CCM code, FOV 9 ... bits 1-0: CCM code, FOV 16  ... (set of 8 CCM codes per word) ...  Word 52 bits 15-14: CCM code, FOV 409 bits 13-0: <zero fill>	4057	4160	u	2	52	0		
<b>FILLER</b>								
<Zero Fill>	4161	4608	i	4	112	0		

## **5 TBCs/TBDs**

TBC1: The valid values of the "Component ID" field in the header record.

TBC2: The values of the "Spacecraft Identification Code" field in the header record for the Metop satellites, and their origin.

TBD1: The content and format of the secondary header record.

TBD2: The unit of measure, scale factor, and content of the "Change in Spacecraft Velocity" field in the header record.

TBD3: The unit of measure and scale factor of the "Spacecraft Mass" field in the header record.

## **6 Notes**

1. In the Level 0 GDS from Metop, there will be 5 words of Internal Target Temperature readings (not 3), 5 words of Patch Temperature readings (not 1), and 50 words of Back Scan readings (not 30). It is assumed this extra data is meaningless. Therefore, onboard the NOAA satellites it is being ignored by the MIRP. It is also assumed that during ingest of the Metop GDS, this extra data will be ignored as well.

## 7 Acronyms

A/D	Analog-to-Digital
AELDS	Advanced Earth Location System
AMSU	Advanced Microwave Sounding Unit
ASCII	American Standard Code for Information Interchange
AU	Astronomical Unit
AVHRR	Advanced Very High Resolution Radiometer
CLAVR	Clouds From AVHRR
cm	centimeter
CPIDS	Calibration Parameters Input Data Set
D/A	Digital-to-Analog
FOV	Field Of View
FRAC	Full Resolution Area Coverage
GAC	Global Area Coverage
GDS	Global Data Set
HRPT	High Resolution Picture Transmission
IJPS	Initial Joint Polar-orbiting Operational Satellite System
IR	Infrared
km	kilometer
LAC	Local Area Coverage
Metop	Meteorological Operational Satellite
MHz	Megahertz
NOAA	National Oceanic and Atmospheric Administration
PACS	Polar Acquisition and Control Subsystem
PRT	Platinum Resistance Thermometer
SAIP	Stored AIP
SOCC	Satellite Operations Control Center
STIP	Stored TIP
TBC	To Be Confirmed
TBD	To Be Determined
TIP	TIROS Information Processor
UTC	Universal Time Coordinated
YGC	Yaw Gyrocompassing